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METRIC PRIMER

A

TEXT-BOOK FOR BEGINNERS

WITH FOLDING CHART AND SCHOLAR'S METER

Prepared for the Society by a Practical Teacher

Second Revision. Third Edition.

BOSTON
AMERICAN METRIC BUREAU
[Merrill Denny, Sec'y, 37 Hanley Street]
1879

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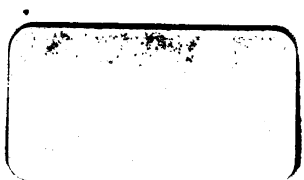

Exch. A. J. Huston March 1, 1928.

Rosa E. Lee.

Cary 1- 15th

"Yellow Fish Creek"

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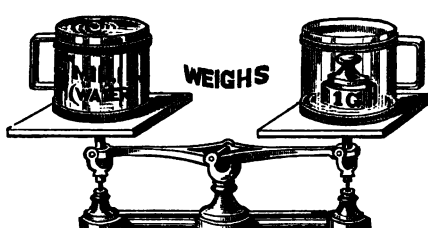

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TO THE TEACHER.

The old fashion of question and answer has been revived in this primer, because it is believed to be, when judiciously used, one of the best methods of giving instruction to beginners. To carry out the plan of the book, the learner need not commit to memory verbatim the answers to the questions; but he should grasp their meaning, and gain command of words, either those of the book or his own, so that he may intelligently express that meaning when he comes to recite. To this end the teacher should take care that in recitation the learner combine the question with the answer in such a manner as to present a complete thought or proposition, and to show that he knows to what he is making answer. After the question and answer recitation, a summary may be made by the learner, either with or without the aid of the teacher. Indeed, the book may be used solely for topical recitation by older students who are beginners in learning the Metric System. It is therefore adapted to several grades of schools. A mere memory exercise is far from being all that it contemplates; it is designed to be, and, by a good teacher, can be made, a true text-book,—the basis and sugges-

tion of many topics of pleasant and useful talk. Even without a teacher, the simple text may, it is hoped, be clearly understood; the aim having been to unfold the subject so gradually, and to make the steps of progress so easy, that any one following the course should not fail to get a fair knowledge of the theory, and some proficiency in the practice of the Metric System. In the whole study one point is of prime importance, — the actual seeing and handling of the objects under discussion. The meter, the liter, and the kilo should be as familiar to the student as are the yard, the quart, and the pound.

To recite fluently the words of the book, and to work readily and correctly the examples for practice, will not be to learn the Metric System, or to make the best use of this primer. It is preëminently a book of object-lessons. The objects lacking, the lessons lose their chief value and interest.

S. L. B.

CHAPTER 1.

WHAT THE METRIC SYSTEM IS.

NOTE. — *Combine the question with the answer in such a manner as to present a complete thought or proposition.*

What is this Primer for?

To teach something about the Metric System.

What is the Metric System?

A method of measuring and weighing.

Why should we learn this method?

Because our Government advises its use in the United States.

Why will it be better to use the Metric System than to keep our old measures and weights?

Because the Metric System is much simpler, and because it is now used by most of the civilized nations.

What gain is it to have our system like that of other nations?

It makes trade with them easier; since, when all buy and sell by the same measures, we can readily compare prices and reckon gains or losses.

Why do scholars and students of science favor the Metric System?

Because it will save much time and labor of study to have the words and signs for measures and weights mean the same thing in the books of all languages.

How many nations now use the Metric System?

Twenty-seven nations use it, and in eighteen of these nations all other measures are unlawful, so that people are compelled to use it.

Why is this system simpler than the old method of measuring by feet and weighing by pounds?

Because it is a decimal system.

What is a decimal system?

A system where ten of each kind of measures or weights make one of the next greater.

What is the system of United States money?

A decimal system.

Will you show how it is a decimal system?

Ten mills make one cent, ten cents make one dime, ten dimes make one dollar, ten dollars make one eagle.

What is the system of writing numbers?

A decimal system.

Will you show how?

Ten units make one ten, ten tens make one hundred, ten hundreds make one thousand — and so forth.

What gain would it be to school children to have the Metric System prevail?

It would save their time and pains in learning long, hard tables of measures, where $5\frac{1}{2}$, $16\frac{1}{2}$, $80\frac{1}{4}$, $272\frac{1}{4}$, $7\frac{92}{100}$, etc., times one kind of measure make one of the next greater. By its decimal character, they would be instructed more rapidly and thoroughly in the properties of numbers, and thus, in the opinion of most teachers, would save a year of their school life.

What gain would it be to them later in life?

It would simplify their business calculations; giving greater accuracy with a great saving of time. Since the time of clerks and accountants costs money, a great saving of money to business men would result.

How do we measure length by the new system?

We use the meter [mee'-ter].

What is the measure next greater than the meter?

The ten-meter.

What is next greater than the ten-meter?

The hundred-meter.

What is next greater than the hundred-meter?

The thousand-meter.

What is the measure next smaller than the meter?

The tenth-meter.

What is the measure next smaller than the tenth-meter?

The hundredth-meter.

What is the measure next smaller than the hundredth-meter?

The thousandth-meter.

What do we use for measuring liquids?

The liter [lee'-ter].

What are the measures greater than the liter?

The ten-liter, the hundred-liter, and the thousand-liter.

What are the measures smaller than the liter?

The tenth-liter, the hundredth-liter, the thousandth-liter.

What is the metric weight?

The gram.

What are the weights greater than the gram?

The ten-gram, the hundred-gram, and the thousand-gram.

What are the smaller weights?

The tenth-gram, the hundredth-gram, the thousandth gram.

Must we know how these measures differ from the old ones?

Not after the Metric System takes the place of the old system; for then the old names will go out of use.

Have such changes ever taken place?

Yes; our money was formerly in pounds, shillings, and pence, instead of dollars and cents.

What fixes the metric measures and weights?

At Paris are the standard measures from which all countries take the most perfect copies that can be made, and in the capital of each country or State is kept a set of measures and weights with which all those used by the people must agree.

How was the length of the meter fixed?

The distance on the earth's surface from the equator to either pole was divided into ten million equal parts; the length of each of these parts was called a meter.

Why was a measure of the earth selected as the standard?

Because a measure of the earth is less likely to change than any other which is known.

CHAPTER 2.

MEASURING LENGTH.

What is this measure[1] which is marked off into ten equal parts?

It is a meter.

What is each of these ten equal parts called?

Each of the ten equal parts of a meter is called a deci-meter (dési-meeter).

What does *deci* mean?

Deci comes from Latin, and means *one-tenth.*

Why use a Latin word instead of the English word *tenth?*

Because the Latin word is understood by all nations alike to mean *one-tenth;* but, if we used the English word, no other people would understand us, and we should not understand them if they used German, French, Swedish or other foreign words.

What are the ten smaller parts into which the decimeter is marked off?

Each of the ten equal parts of a decimeter is called a cen'ti-meter.

What is the meaning of *centi?*

Centi means *one hundredth.* It is from Latin.

Why should it be called a centi-meter, or a hundredth of a meter?

Since there are ten decimeters in a meter, if each of these ten be divided into ten equal parts, there

[1] A meter measure should be in the hands of each learner; such a measure is furnished, without charge, with each copy of this primer.

will then be one hundred parts in the meter, and each of these equal parts will be one-hundredth part of a meter, or a centi-meter.

What is each of the ten divisions into which the centimeter is marked off?

Each of the ten divisions of a centimeter is called a milli'-meter.

What is the meaning of *milli?*

Milli means *one thousandth.*

Why is each of these ten equal divisions of a centimeter called a milli-meter, or a thousandth of a meter?

Since there are one hundred centimeters in a meter, if each of these be divided into ten equal parts, there will then be one hundred tens or one thousand such parts in the meter, and each of these parts will be a thousandth of a meter, or a millimeter.

Will you measure with the meter six meters of tape,[1] and show how to write the length?

6 m.

Will you measure six meters five decimeters, and how to write it?

$6^{m}{\cdot}5$; since 5 decimeters equal 50 centimeters, it may also be written $6^{m}{\cdot}50$.

Which is the more common method?

To write centimeters rather than decimeters, just as we write 60 cents instead of 6 dimes.

Will you measure four meters three decimeters, and show how to write it?

$4^{m}{\cdot}3$ or $4^{m}{\cdot}30$.

Will you measure four meters three centimeters, and show how to write it?

$4^{m}{\cdot}03$.

---

[1] There should be for the use of the learner a ball of tape or twine.

How will you write five meters, six decimeters, seven centimeters, eight millimeters?

$5^{m}.678$.

Would a man in business be likely to read a number as it is written out in the last question?

No; he would read 5 *meters*, 678 *millimeters*, or merely 5 *meters* 678.

Will you measure ten meters of tape, and show how to write it?

10 m.

What name is given to a length of ten meters?

It is called a dek'a-meter.[1]

What is the meaning of *deka*?

It comes from a Greek word, and means *ten*.

How will you write one dekameter?

1 Dm.

Will you measure 20 meters, or 2 dekameters, and show how to write it?

20 m. or 2 Dm.

How will you read 25 Dm.?

Twenty-five dekameters.

How will you read 25 dm.?

Twenty-five decimeters.

How will you read 3 Dm.?

Three dekameters.

How will you read 3 dm.?

Three decimeters.

What is the difference between the dekameter and the decimeter? [Show this with a piece of tape or string.]

The dekameter is ten times the meter; the decimeter is one-tenth of the meter.

---

[1] The teacher should show to the learner an extended dekameter tape measure or chain, to give a clear idea of the length.

I measure ten dekameters' length; how shall I write it?

10 Dm.

What name is given to a length of ten dekameters?

A hekto-meter.

What is the meaning of hekto?

It means *one hundred.*

Why is the length of ten dekameters called a hektometer?

Because, as there are ten dekameters, in each of which are ten meters, there are in all ten times ten or one hundred meters, or a hektometer.

How will you write one hektometer?

1 Hm.

How will you write 75 hektometers?

75 Hm.

How will you write eight hundred-meters?

8 Hm.

How will you write eight hektometers?

8 Hm.

In what two ways will you read 5 Hm.?

Five hektometers or five hundred meters.

What is one hundredth of a meter? [Show it with the tape.]

A centimeter.

What is one hundred meters? [Show it with the tape, by measuring the distance in the yard or on the street.]

A hektometer.

I measure ten hektometers: how shall I write the length?

10 Hm.

What name is given to ten hektometers' length?

One kil'ometer.

What is the meaning of *kilo?*

Kilo means *one thousand.*

Why is ten hektometers' length called a kilometer or a thousand meters?

Since there are ten hektometers, each consisting of ten dekameters, and in each of the ten dekameters are ten meters, there will be in all ten times ten tens or one thousand meters, which make a kilometer.

How will you write fifteen kilometers?

15 Km.

How will you write 758 kilometers?

758 Km.

How will you write four thousand meters?

4 Km. or 4000m.

What is a kilometer?

One thousand times a meter.

What is a millimeter?

One thousandth part of a meter.

Will you name the measures from the lowest up to the meter?

Millimeter, centimeter, decimeter.

How will you write these briefly?

mm., cm., dm.

Will you name the measures greater than the meter from the thousand down?

Kilometer, hektometer, dekameter.

Will you write them briefly?

Km., Hm., Dm.

How will you enumerate $6543^{m}\cdot321$?

6	5	4	3	.	3	2	1
Km.	Hm.	Dm.	m.		dm.	cm.	mm.

How will you write 3 decimeters?

$0^{m}\cdot3$ or 3 dm.; but in business, decimeters are usually written as centimeters; $0^{m}.30$ or 30 cm.

How will you write 50 centimeters?

$0^{m}\cdot 50$ or 50 cm.

How will you write 95 kilometers and 5 hektometers?

$95^{Km.}5$.

Is there any difference in length between 1 Km., 10 Hm., 100 Dm., 1000 m.?

They all express the same length.

Which form is it best to use?

Either Km. or m., whichever is most simple and convenient for the case in hand.

In measuring cloths, carpets, and other such fabrics, what is the mode of writing the length?

It is written in meters and fractions of a meter.

If your slate pencil is one decimeter long, how would you write its length?

10 cm. or 1 dm.

Will you measure your Metric Primer, and write its length and its width?

Will you measure the width of the margin of the leaf, and write it?

How will you read 8 dm.?

Eight decimeters.

How will you read 27 cm.?

Twenty-seven centimeters.

How will you read $0^{m}\cdot 27$?

Twenty-seven centimeters.

How will you read 7 cm.?

Seven centimeters.

How will you read $0^{m}\cdot 07$?

Seven centimeters.

How will you read 50 cm.? how $0^{m}\cdot 50$?

Fifty centimeters.

How will you read 35 mm.?

Thirty-five millimeters.

How will you read 4 m.?

Four meters.

How will you read $4^{m}.4$?

Four meters, four decimeters; or more commonly four meters, forty centimeters; or simply 4 meters 40.

How will you read $3^{m}.33$?

Three meters, thirty-three centimeters.

How will you read $5^{m}.05$?

Five meters, five centimeters.

How will you read $2^{m}.002$?

Two meters, two millimeters.

How will you read $0^{m}.013$?

Thirteen millimeters.

How will you read 13 mm.?

Thirteen millimeters.

How will you read 326 cm.?

Three hundred twenty-six centimeters.

How will you read 85 Km.?

Eighty-five kilometers.

How will you read $78^{Km}.356$?

Seventy-eight kilometers, three hundred fifty-six.

What is the 356?

It is 356 thousandths of a kilometer, or 356 meters.

How will you read $3845^{m}.678$?

I may read it 3845 meters, 678 millimeters, or I may read 3 kilometers, 8 hektometers, 4 dekameters, 5 meters, 6 decimeters, 7 centimeters, 8 millimeters.

Which is the better way?

The shorter.

How would the distance from Boston to Paris be written?

As a certain number of kilometers.

How would the distance across your school-room be written?

As a certain number of meters.

How would the length of your slate be written?

As a certain number of centimeters.

How would the length of the letters of your book be written?

As a certain number of millimeters.

Which of our present measures is the meter most like?

The yard, which is a little less than a meter.

Will you repeat the table[1] of long measure?

10 milli meters make 1 centi meter.
10 centi meters " 1 deci meter.
10 deci meters " 1 meter.
10 METERS " 1 deka meter.
10 deka meters " 1 hekto meter.
10 hekto meters " 1 kilo meter.
10 kilo meters " 1 myria meter.

What four lengths are very seldom used?

The hektometer, the dekameter, the decimeter, and the myriameter.

Can you briefly state the substance of this chapter?

Measure all lengths in meters, using decimal fractions only, and saying deci for tenth, centi for hundredth, milli for thousandth, deka for ten, hekto for hundred, kilo for thousand, and myria for ten thousand.

---

[1] The teacher should explain that, properly speaking, there are no tables in the metric system. The above table is only an exercise in numeration, being simply —

10 thousandths make 1 hundredth.
10 hundredths " 1 tenth.
10 tenths " 1 unit.
10 units " 1 ten, etc.

EXAMPLES FOR PRACTICE.

1.

Write
1. Five meters.
2. Eight meters.
3. Ten meters.
4. One dekameter.
5. Fifteen meters.
6. One dekameter and five meters.
7. Three hundred and five meters.
8. Three hektometers, no dekameters, five meters.
9. Six thousand four hundred fifty-six meters.
10. Six kilometers, four hektometers, five dekameters, six meters.

2.

Write
1. Five meters and six decimeters.
2. Fifty-five meters, six decimeters, seven centimeters.
3. Four hundred fifty-five meters, six decimeters, seven centimeters, eight millimeters.
4. Three decimeters.
5. Eight centimeters.
6. Nine millimeters.
7. Three hundred centimeters.
8. Nine thousand seven hundred fifty-eight millimeters.
9. Five kilometers, five hektometers, five dekameters, five meters.
10. Five meters, five centimeters, five decimeters, five millimeters.

3.

Find the sum of:

1. 5 mm., 65 cm., 38 dm., 93 m., 82 Dm., 95 Hm. 34 Km., 30 Km. 8 m., 9 cm.
2. 65 Km., 85 Km., 93 Km., 25 m., 30 m.
3. $6^{m}\cdot55$, $8^{Km}\cdot345$, $9^{m}\cdot83$, $82^{Km}\cdot05$, 8 mm.
4. 4 mm., 4 m., 4 dm., 4 Dm., 4 cm.
5. Five meters, twenty-five meters, thirty-five meters, one hundred meters, two hundred fifty meters.
6. Five meters, two dekameters, five meters, three dekameters, five meters, one hektometer, two hektometers, five dekameters.
7. Six meters, one decimeter, three dekameters, five centimeters, eight millimeters.
8. Seven thousand kilometers, seven thousand meters, seven thousand centimeters, seven thousand millimeters, seven thousand hektometers.
9. Ten millimeters, ten centimeters, ten decimeters, ten meters, ten dekameters, ten hektometers, ten kilometers.
10. 345 Km., $948^{Km}\cdot52$, $785^{Km}\cdot5$, $342^{Km}\cdot845$, $786^{Km}\cdot2$.

4.

1. Writing paper is of three sizes: letter, 25 cm. long, 20 cm. wide; note, 20 cm. long, $12\frac{1}{2}$ cm. wide; foolscap, 30 cm. long, 20 cm. wide; what is the sum of the lengths of the three sizes? What is the sum of the widths?
2. Tables are of five sizes: number one, 50 cm. long; number two, 60 cm. long; number three, 80 cm. long; number four, 1 m. long; number five, 140 cm. long; what is the sum of the lengths?
3. If the width of each is one-half its length, what is the sum of the widths?
4. A shopkeeper sells ribbon to ten girls: to the first he sells 5 m.; to the second, 4 m.; to the third, 50 cm.; to the fourth, $0^{m}\cdot5$; to the fifth, $0^{m}\cdot50$; how many meters does he sell to all?

5. Five boys measure in height as follows: A, 130 cm.; B, 125 cm.; C, 120 cm.; D, 130 cm.; E, 150 cm. How many centimeters do they all measure? How many meters?
6. A man walked from Boston, on the Maine Railroad, six days: Monday he walked 30 Km.; Tuesday, 35 Km.; Wednesday, 26 Km.; Thursday, 28 Km.; Friday, 29 Km.; Saturday, 35 Km. How many kilometers did he walk in the six days?
7. If you walk to the post-office, 1 Km.; to the library, ½ Km.; to the depot, $0^{Km.}50$; to the church, 2 Km.; to the market, 1 Km.; how many kilometers do you walk?
8. From Boston to Portsmouth the distance is about 86 Km.; from Portsmouth to Portland, 84 Km.; from Portland to Bangor, 216 Km. How far from Boston to Bangor?
9. From Boston to Albany the distance is about 320 Km.; from Albany to Chicago, 1336 Km.; from Chicago to San Francisco, 3850 Km. How far from Boston to San Francisco?
10. How far is it from San Francisco to Bangor?

5.

1. The Mississippi river is 6720 Km. long; the Missouri river is 4650 Km. long. What is the difference in their length?
2. The Colorado river is 1600 Km. long; the Columbia river is 1630 Km. long. What is the difference between the sum of their lengths and the sum of the lengths of the Mississippi and Missouri?
3. The distance of the earth from the sun is about 156,800,000 Km.; the distance of the planet Mars from the sun is 232,000,000 Km. The earth and Mars both being on the same side of the sun, and in the same line, what is the distance between the earth and Mars?
4. What is the difference in length of two pins, one of them being two centimeters, the other twenty-six millimeters long?

5. What is the difference of length of two gold chains, one being a hundred and thirty centimeters, the other twelve decimeters long?
6. What is the difference of diameter of two rings, one being two centimeters, the other twenty millimeters in diameter?
7. From 1 m. take 1 mm.
8. From 5 dm. take 5 cm.
9. From 10 m. take 10 mm.
10. From 100 Km. take 100 mm.

6.

1. When silk is $2.00 the meter, what will 20 m. cost?
2. Bought carpeting at $2.00 the meter, what did 50 m. cost?
3. Bought 30½ m. French merino, at $1.00
   10 m. silk fringe, at .75
   4 m. lace, at 2.00
   20 m. velvet, at 8.00
   What is the amount of the bill?
4. What length of wood will be required for ten rulers, each 40 cm. long?
5. If a train of cars runs 60 Km. an hour, what distance does it run in 24 hours?
6. A merchant has 30 meters of broadcloth. He divides it among a number of his clerks, giving to each 100 centimeters. To how many clerks does he distribute it?
7. From a piece of linen 10 meters long, how many towels, each 50 centimeters long, can be cut?
8. How many times is 1 mm. contained in 1 m.?
9. How many times is 1 cm. contained in 1 m.?
10. How many times is 1 mm. contained in 1 Km.?

CHAPTER 3.

MEASURING SURFACE.

Draw a line a centimeter long, and make a square on this line. What will you call this square?

A square centimeter.

Divide one side of this square centimeter into millimeters. How many will there be, and how many square millimeters can you make from side to side in one row?

There are 10 millimeters on a side, and I can make 10 square millimeters in a row.

How many rows of square millimeters can you make?

I can make 10 rows of square millimeters.

How many square millimeters will there be in all, if there are 10 in each row, and 10 rows?

There are 100 square millimeters in a square centimeter.

How does the side of a square centimeter compare with the side of a square millimeter?

It is 10 times as long.

How does the surface of a square centimeter compare with the surface of a square millimeter?

It is 100 times as great.

In 8 square centimeters how many square millimeters?

800 sq. mm.

In 25 square centimeters how many square millimeters?

2500 sq. mm.

In 600 square millimeters how many square centimeters?

6 sq. cm.

In 2000 square millimeters how many square centimeters?

20 sq. cm.

What is the surface of a bit of paper which is 8 mm. long and 6 mm. wide?

48 sq. mm.

Why?

Since the paper is 8 mm. long, there can be made on one side of it a row of 8 sq. mm.; and, since it is 6 mm. wide, there can be made 6 rows: 6 rows of 8 sq. mm. equal 48 sq. mm.

How many square centimeters in 300 sq. mm.?

3 sq. cm.

What is the surface of a card which is 50 mm. long, 75 mm. wide?

3750 sq. mm., or $37^{\text{sq.cm.}}\,5$.

Draw on your slate a line a decimeter long, and make a square on this line.[1] What will you call this square?

A square decimeter.

Divide one side of this square decimeter into centimeters. How many will there be, and how many square centimeters can you make from side to side in one row?

There are 10 centimeters in a side, and I can make 10 square centimeters in a row.

How many rows of square centimeters can you make?

I can make 10 rows of square centimeters.

How many square centimeters will there be in all, if there are 10 in each row, and 10 rows?

There are 100 square centimeters in a square decimeter.

How does the side of a square decimeter compare with the side of a square centimeter?

It is 10 times as long.

---

[1] The teacher should take care that this is actually done by the learner.

How does the surface of a square decimeter compare with the surface of a square centimeter?

It is 100 times as great.

In 5 square decimeters how many square centimeters?

500 sq. cm.

In 15 square decimeters how many square centimeters?

1500 sq. cm.

In 400 square centimeters how many square decimeters?

4 sq. dm.

In 1200 square centimeters how many square decimeters?

12 sq. dm.

What is the surface of a sheet of paper which is 9 cm. long and 8 cm. wide?

72 sq. cm.

Why?

Since the paper is 9 cm. long, there can be made on one side of it a row of 9 sq. cm.; and, since it is 8 cm. wide, there can be made 8 rows: 8 rows of 9 sq. cm. equal 72 sq. cm.

How many square decimeters in 900 sq. cm.?

9 sq. dm.

What is the surface of a card that is 12 cm. long and 12 cm. wide?

144 sq. cm., or $1^{\text{sq.dm.}}\,44$.

Draw on the blackboard or on the floor a line one meter long. Make a square on this line.[1] What will you call this square?

A square meter.

Divide one side of this square meter into decimeters. How many will there be, and how many square decimeters can you make from side to side in one row?

There are 10 decimeters on a side, and I can make 10 square decimeters in a row.

[1] The teacher should take care that this be done.

How many rows of square decimeters can you make?

I can make 10 rows of square decimeters.

How many square decimeters will there be in all, if there are 10 in each row, and 10 rows?

There are 100 square decimeters in a square meter.

How does the side of a square meter compare with the side of a square decimeter?

It is 10 times as long.

How does the surface of a square meter compare with the surface of a square decimeter?

It is 100 times as great.

In 7 square meters how many square decimeters?

700 sq. dm.

In 14 square meters how many square decimeters?

1400 sq. dm.

In 200 square decimeters how many square meters?

2 sq. m.

In 3000 square decimeters how many square meters?

30 sq. m.

What is the surface of a sheet of paper that is 3 decimeters long and 2 decimeters wide?

6 sq. dm.

Why?

Since the paper is 3 dm. long, there can be made on one side of it a row of 3 sq. dm., and, since it is 2 dm. wide, there can be made 2 rows: 2 rows of 3 sq. dm. equal 6 sq. dm.

How many sq. meters in 200 sq. dm.?

2 sq. m.

What is the surface of a newspaper which is 16 dm. long and 10 dm. wide?

160 sq. dm. or $1^{\text{sq.m.}}60$.

How will you write six sq. meters, twenty-five sq. decimeters?

$6^{\text{sq m.}}25$.

How will you write six sq. meters, twenty-five sq. centimeters?

$6^{sq.m.}0025$, or $6^{sq.m.}25^{sq.cm.}$

How will you write 8 sq. meters, 7 sq. decimeters, 6 square centimeters, 5 square millimeters?

$8^{sq.m.}070605$.

How will you write 1 sq. m., 1 sq. dm., 1 sq. cm., 1 sq. mm.

$1^{sq.m.}010101$.

How do you read $6^{sq.m.}0606$?

Six sq. m., six sq. dm., six sq. cm.; or six sq. m., six hundred six sq. cm.

Why are two places given to each denomination in writing the figures for surface measure?

Since it takes 100 of each denomination to make one of the next higher denomination, each denomination requires two places in which to write its units up to 99.

What part of a sq. meter is a sq. decimeter?

One hundredth.

How will you write one sq. meter and one sq. decimeter?

$1^{sq.m.}01$.

How will you write 3 sq. meters, 3 sq. decimeters, 3 sq. centimeters?

$3^{sq.m.}0303$.

How will you read 1234567 sq. mm., naming the denominations in order?

$1^{sq.m.}23^{sq.dm.}45^{sq.cm.}67^{sq.mm.}$

How will you read 20202020202 sq. mm.?

$20,202^{sq.m.}2^{sq.dm.}2^{sq\ cm.}2^{sq.mm.}$

With a dekameter or ten-meter measure, draw on the floor or in the yard a line a dekameter long, and make a square on that line. What will you call the square?

A square dekameter.

How many meters on the side of a square dekameter, and how many square meters can you make from side to side in a row?

There are 10 meters in a side, and I can make 10 square meters in a row.

How many rows of square meters can you make?

I can make 10 rows of square meters.

How many square meters will there be in all if there are 10 in each row and 10 rows?

There are 100 square meters in a square dekameter.

How does the side of a square dekameter compare with the side of a square meter?

It is 10 times as long.

How does the surface of a square dekameter compare with the surface of a square meter?

It is 100 times as great.

In 5 square dekameters, how many square meters?

500 sq. m.

In 21 square dekameters, how many square meters?

2100 sq. m.

In 500 sq. meters, how many square dekameters?

5 sq. Dm.

In 2100 sq. meters, how many sq. dekameters?

21 sq. Dm.

What is the surface of a floor which is 7 meters long and 5 meters wide?

35 sq. m.

Why?

Since the floor is 7 m. long, there can be made on one side of it 7 sq. meters; and, since it is 5 m. wide, there can be made 5 rows: 5 rows of 7 sq. meters equal 35 sq. m.

How many square dekameters in 800 square meters?

8 sq. Dm.

What is the surface of a hall floor that is 30 m. long and 22 m. wide?

660 sq. m.

From a ball of tape or twine, measure off a length of 10 dekameters, or 100 meters, which is called a hektometer; it will be too long for you to draw a line by, but you may make a knot in each end, and with a nail or pin fasten it to the ground. If you now make a square on this, what will the square be?[1]

A square hektometer.

How many dekameters in the side of a square hektometer, and how many square dekameters can you make from side to side in a row?

There are 10 dekameters in a side, and I can make 10 square dekameters in a row.

How many rows of square dekameters can you make?

I can make 10 rows of square dekameters.

How many square dekameters will there be in all, if there are 10 in each row and 10 rows?

There are 100 square dekameters in a square hektometer.

How does the side of a square hectometer compare with the side of a square dekameter?

It is 10 times as great.

How does the surface of a square hektometer compare with the surface of a square dekameter?

It is 100 times as great.

In 3 square hektometers how many square dekameters?

300 sq. Dm.

In 15 square hektometers how many square dekameters?

1500 sq. Dm.

What is the surface of a floor that is 2 dekameters long and 2 dekameters wide?

4 square dekameters.

[1] In the country a field can easily be found large enough to lay out the sq. Hm. or Hektar, and it will add greatly to the practical knowledge of the pupils. Set up flags at each corner.

What is the surface that is 25 dekameters long and 20 dekameters wide?

500 sq. Dm., or 5 sq. Hm.

What is the surface that is 35 dekameters long and 25 dekameters wide?

875 sq. Dm., or $8^{\text{sq. Hm.}}75$.

How will you write six sq. hektometers, six sq. dekameters, six sq. meters?

$6^{\text{sq. Hm.}}0606$.

Will you read 54326 sq. m., naming the denominations?

5 sq. Hm., 43 sq. Dm., 26 sq. m.

Will you write 5 sq. Hm., 5 sq. Dm., 5 sq. m.?

$5^{\text{sq. Hm.}}0505$.

Will you write 5 of each denomination from sq. Hm. to sq. mm.?

$5^{\text{sq. Hm.}}0505050505$.

Will you read the above, naming each denomination?

5 sq. Hm., 5 sq. Dm., 5 sq. m., 5 sq. dm., 5 sq. cm., 5 sq. mm.

When the square meter, the square dekameter, and the sq. hektometer are used as measures of land, what names may they take?

The square hektometer is called the hektar;[1] the square dekameter is called the ar; the square meter is called the centar.

How many ars in a hektar?

100 a.

How many centars in an ar?

100 ca.

If A has 2500 a. of land, and B has 2500 sq. Dm., which has the greater lot?

Both lots have the same area.

---

[1] *Ar* is a part of the word *area;* it is pronounced like *are*, and is sometimes spelled *are*, though less correctly.

If A has 2500 ca., and B has 2500 sq. m., which has the greater lot?

Their lots are of the same size.

A boy has a square garden, an ar in size; he wishes to make it into square beds of a centar each. How many can he make?

100.

A man bought a hektar of land for $10 per ar, and sold it for $12 per ar. How much money did he gain?

He gained $2.00 on every ar. A hektar is 100 ars; therefore he gained $200.

A farmer has three square lots to fence; the first is one hektar, the second is one ar, the third is one centar. How much fence will be needed for all?

For the hektar, 400 meters; for the ar, 40 meters; for the centar, 4 meters; for all, 444 meters.

If a man owns a hektar of land, and sells an ar of it, how much will be left?

99 ars.

How will you write 7 ars?

7 a.

How will you write 7 ars and 7 centars?

$7^{a.}07$, or $7^{a.}\ 7^{ca.}$

How will you write 7 hektars, 7 ars, 7 centars?

$7^{Ha.}0707$.

How will you write 6 hektars and 66 ars?

$6^{Ha.}66$.

How will you write 6 hektars and 6666 sq. meters?

$6^{Ha.}6666$.

If a man buys of one person a hektar of land, of another person, 100 ars, of another, 10,000 centars, of which does he buy the most land?

He buys the same quantity of each.

What surface measures now in use are represented by any of the metric surface measures?

The hektar is nearest to the acre; it is a little over two acres. The centar or sq. meter is a little over a sq. yard.

Which of these special names for land measures are very seldom used?

The ar and centar.

What are mostly used in measuring land?

Hektars and sq. meters.

Can you briefly state the substance of this chapter?

Measure all surfaces by the squares of the measures of length, using decimal fractions only. The ar is another name for the sq. dekameter of *land*. The centar is a square meter.

EXAMPLES FOR PRACTICE.

1.

1. Write eighty-five sq. m., eighty-five sq. dm., eighty-five sq. mm.
2. Three sq. m., three sq. dm., three sq. cm., three sq. mm.
3. Ten sq. m., ten sq. dm., ten sq. cm., ten sq. millim.
4. Nine sq. m., nine sq. centim., nine sq. millim.
5. Four sq. meters, four sq. centimeters.
6. Fifty-five centars.
7. Fifty-five ars.
8. Fifty-five hektars.
9. Fifty hektars, fifty ars, fifty centars.
10. One hektar, one ar, one centar.

2.

1. A carpet-dealer sold carpets for three halls. The first would cover a floor of 600 sq. meters; the second would cover a floor 20 meters long and 30 meters wide; the three were in a roll 1600 meters long, and one meter wide. What did they all cost at $2.00 the meter? and how long was each? How many meters of paper would line the carpets, the lining being $1^{m}\cdot 50$ wide?
2. The length of a rectangular piece of ground is 13 Dm., and its width 7 Dm., what is its area?
3. A painter paints the walls of 3 rooms. The first has a surface of 3200 sq. m.; the second is 20 m. long, 12 m. wide, 7 m. high; the third is 30 m. long, 15 m. wide, 6 m. high. There are in each of the three rooms 2 windows, 3 m. high, 1 m. wide. How many sq. meters of painting in the walls of the rooms, deducting the windows?
4. What is the sum of 3 Ha., 25 Ha., 10 Ha., 8 a., 16 a., 24 a., 12 ca., 8 ca., 6 a.?
5. Add 5 Ha., 5 a., 5 ca.
6. From 25 Ha. subtract 25 a.
7. From 60 a. subtract 60 ca.
8. Add 8 times 3 Ha., 9 times 9 a., 10 times 6 ca.
9. Divide 125000 ca. into 50 equal parts.
10. If you divide 5 Ha. into parts, each $2^{sq\cdot m}\cdot 50$, how many parts will there be?

CHAPTER 4.

MEASURING SOLIDITY OR VOLUME.

Take a block of wood, or, what you can cut more easily, a slice of bread; measure a piece 1 mm. long, 1 mm. wide, 1 mm. thick; it is not large enough to cut off nicely, and therefore we will not try to work with it. What is such a piece called, having its length, width, and thickness the same?

That which has its length, width, and thickness the same, is called a cube.

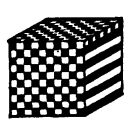
What is the cube called which has its length, width, and thickness each 1 mm.?

A cubic millimeter.

How many such cubes would make a cube whose side is 10 times as long, or a cubic centimeter?

1000 cu. millimeters make a cu. centimeter.

Will you now cut a piece which shall be 1 centimeter long, 1 centimeter wide, 1 centimeter thick? [The best way to do it is to cut a strip of the right width and thickness, and then from the end cut off the right length.]



What is this called?

A cube 1 centimeter in length, width, and thickness, is called a cubic centimeter. In liquid measures it is sometimes, but not often, called a milliliter.

How many such cubes would you put in a strip to make a decimeter's length?

I should put 10 cubic centimeters together to make a strip a decimeter's length.

How many such strips would you put together to make a square?

I should put together ten such strips to make a square.

How long and how wide is this square made of the strips?

It is 1 decimeter long, and 1 decimeter wide.

How many cubes or cubic centimeters are there in this square layer?

100 cu. centimeters.

If you pile up layers enough to make the pile 1 decimeter high, how many layers will there be?

There will be 10 layers.

How many cubes or cubic centimeters are in each layer?

There are 100 cubic centimeters in each layer.

How many cubic centimeters will there be in the 10 layers?

There will be 1000 cubic centimeters in the 10 layers.

How long, how wide, and how thick is the pile thus made, and what is it called?

It is 1 decimeter in length, in width, and in thickness; it is called a cubic decimeter.

How many cubic centimeters therefore make a cubic decimeter?

1000 cubic centimeters make 1 cubic decimeter.

How many such cubes or cubic decimeters would you put together to make a strip 1 meter in length?

I should put 10 cubic decimeters together to make a strip 1 meter in length.

The Metric Bureau furnishes blocks by which to show these relations. The learner should perform for himself the operations with the various blocks. If only one set can be afforded, let this be passed from one to another. The 1, 10, 100, 1000 cubic centim. blocks are all the sizes practicable for school use.

How many such strips, each of 10 cubic decimeters, would you put together to make a square?

I should put together 10 such strips to make a square.

How long and how wide is this square?

It is 1 meter long and 1 meter wide.

How many cubes or cubic decimeters are there in this square layer?

100 cu. decimeters.

If you pile up layers enough to make the pile 1 meter high, how many layers will there be?

There will be 10 layers.

How many cubes or cubic decimeters in each layer?

There are 100 cubic decimeters in each layer.

How many cubic decimeters will there be in the 10 layers?

There will be 1000 cubic decimeters in the 10 layers.

How long, how wide, and how thick is the pile thus made, and what is it called?

It is 1 meter in length, in width, and in thickness; it is called a cubic meter.

How many cubic decimeters, therefore, make a cubic meter?

1000 cubic decimeters make 1 cubic meter.

How does the edge of a cubic meter compare with the edge of a cubic decimeter?

The edge of a cubic meter is 10 times as long as the edge of a cubic decimeter.

How does the volume or solidity of a cubic meter compare with the volume or solidity of a cubic decimeter?

The volume of a cubic meter is 1000 times the volume of a cubic decimeter.

How does the edge of a cubic decimeter compare with the edge of a cubic centimeter?

The edge of a cubic decimeter is 10 times the edge of a cubic centimeter.

How does the volume of a cubic decimeter compare with the volume of a cubic centimeter?

The volume of a cubic decimeter is 1000 times the volume of a cubic centimeter.

How does the edge of a cubic centimeter compare with the edge of a cubic millimeter?

The edge of a cubic centimeter is 10 times the edge of a cubic millimeter.

How does the volume of a cubic centimeter compare with the volume of a cubic millimeter?

The volume of a cubic centimeter is 1000 times the volume of a cubic millimeter.

How will you write thirty cubic meters?

30 cu.m.

How will you write three cubic meters?

3 cu.m.

How will you write thirty cubic meters, thirty cubic decimeters?

$30^{cu.\,m.}030$.

How will you write twenty-five cubic meters, twenty-five cubic decimeters, twenty-five cubic centimeters, twenty-five cubic millimeters?

$25^{cu.\,m.}025025025$.

How will you write two cubic meters, two cubic decimeters, two cubic centimeters, two cubic millimeters?

$2^{cu.\,m.}002002002$.

Why are three places given to each denomination?

Since 1000 of each make 1 of the next greater, each one is $\frac{1}{1000}$ of the one next above it, and requires three places in which to write its own units up to 999.

Are there denominations above the cubic meter?

There are none in common use, as they are so large, but in measuring great bodies, like the earth, cubic kilometers might be used.

Are there two names for any of the denominations of cubic measure, as there are for some of surface measure, where the sq. dekameter was called an *ar*?

Yes; in measuring wood, the cubic meter is commonly called a *ster*.[1] Ten sters are called a deka-ster, and a tenth of a ster is called a deci-ster.

Is it necessary to use these other names?

No; it is simpler to measure wood in cubic meters, like all other bulky things.

Can you briefly state the substance of this chapter?

Measure all volumes by the cubes of the measures of length, using decimal fractions only. The ster is another name for a cubic meter of wood.

EXAMPLES FOR PRACTICE.

1.

1. Write 20 cubic dekameters, 20 cubic meters.
2. Write 5 cubic meters, 5 cubic decimeters, 5 cubic centimeters, 5 cubic millimeters.
3. Add $25^{cu.m.}$, $34^{cu.m.}025$, $8^{cu.m.}256$, $35^{cu.m.}002$.
4. From $250^{cu.m.}$ subtract $250^{cu.cm.}$
5. From 4 times $65^{cu.m.}$ subtract 4 times $65^{cu.cm.}$
6. A man made a ditch in his meadow; the earth dug out formed a pile 4 dm. high, 1 m. wide, 40 m. long. How many cu. m. of earth in the pile?

---

[1] Meaning solid, as in stereoscope; also pronounced as in that word.

7. How many cu. m. of water would it take to fill the ditch?
8. How many cu. m. of brick in a wall 20 m. long, 2 m. high, 20 cm. thick?
9. How many sters of wood in a pile 25 m. long, 1 m. high, 1 m. wide?
10. A wood-house contains 25000 cu. meters of wood. How many sters in it?

2.

1. In a pile of wood $8^{m}\cdot3$ long, $2^{m}\cdot2$ high, $1^{m}\cdot5$ wide, how many sters?
2. In a pile $6^{m}\cdot5$ long, $1^{m}\cdot5$ wide, $2^{m}\cdot5$ high, how many sters?
3. In a wood-yard are 50 piles of wood, each of 3 Dst. How many piles can be made each of 1 ster?
4. At $2.00 a ster, what would be the value of the wood in the yard?
5. A wood-box will hold a decister of wood, how many times can it be filled from the wood-yard?
6. If a boy piles 3 cubic meters of wood each hour, how long will it take him to pile all the wood in the yard?
7. A family burns 3 dekasters of wood in a month. how much is that a day, allowing 30 days to the month?
8. A cistern contains 25,000 cu. m. of water. If from it are drawn off every hour, 2 cu. m. of water, how much water is left in the cistern at the end of seven days?
9. An apothecary uses, from a glass holding a cubic decimeter of distilled water, one cubic centimeter every hour. How much does he use in 12 hours? How many cubic centimeters are left?
10. A druggist has a measure which holds 1 cubic decimeter of water. How many measures, each holding 10 cu. centimeters of water, would be required to hold the water of the cu. decimeter?

CHAPTER 5.

MEASURING CAPACITY.

If a cubical inkstand is 1 centimeter long, 1 centimeter wide, 1 centimeter deep (measured on the inside), what is the volume of ink that fills it?

1 cubic centimeter.

If a cubical inkstand is 1 decimeter long, wide, and deep (inside measure), what volume of ink will fill it?

A cubic decimeter.

Is it usual to give these names to measures of liquids?

Chemists and druggists always use the term cubic centimeter, but for common use it is the custom to give shorter names.

What are these shorter names?

The names of cups and vessels into which liquids are put to be measured.

What name has the measure that holds a cubic decimeter?

A liter (lee'ter).

If you make a pile of snow which is a cubic decimeter in size, what measure of capacity will it fill?

A liter.

Take the liter measure,[1] and dip out with it 10 liters of water. What is the measure called which would exactly hold this 10 liters?

A dekaliter.

For what are measures larger than the liter chiefly used?

For measuring large quantities of liquids, or for measuring dry substances, like grain, fruits, vegetables, etc.

[1] The learner should have a liter measure both in the cubical and in the common cylindrical or market form. Water, sand, or grain should be provided for these exercises.

What is the measure next greater than the dekaliter?

The hektoliter.

If a man would put a hektoliter of wine into liter bottles, how many bottles must he have?

100 liter bottles.

What is the measure next greater than the hektoliter?

The kiloliter, which is very seldom used.

If a kiloliter tank were emptied of water and packed solidly with wood, what would be the quantity of wood?

A cubic meter or ster.

Will you name again the two measures of capacity and their equal volumes?

The kiloliter holds a cubic meter or ster; the liter holds a cubic decimeter.

What are the measures smaller than the liter?

The tenth liter or deciliter, the hundredth liter or centiliter, the thousandth liter or milliliter.

Take the liter and fill it with water, using the deciliter. How many deciliters do you pour in?

10 deciliters in the liter.

Keep this liter, and fill the deciliter by pouring into it with the centiliter. How many centiliters do you pour in?

10 centiliters in the deciliter.

Keep the liter and the deciliter of water; fill the centiliter by pouring into it with the milliliter. How many milliliters do you pour in?

10 milliliters in the centiliter.

Lastly, fill the milliliter. How many full cups have you?

Four: liter, deciliter, centiliter, milliliter.

How many milliliters in them all?

The milliliter has 1, cl. has 10, dl. has 100, l. has 1000. All together have 1111 ml.

What measure in common use is the liter most like?

The liter is almost the same as a quart.

What is the hektoliter like?

The hektoliter is nearly three bushels, or is like a small barrel.

What other measures are used for convenience?

Half-liters and double liters.

Are any measures used besides those already mentioned?

Yes; for convenience, the halves and doubles of all the measures from the centiliter to the hektoliter are also used.

Will you write on the blackboard the names of these measures and their contents in liters?

NAME.	LITERS.	NAME.	LITERS.
1 Centiliter.	0.01	2 Liters.	2.00
2 "	0.02	5 "	5.00
5 "	0.05	1 Dekaliter.	10.00
1 Deciliter.	0.10	2 "	20.00
2 "	0.20	5 "	50.00
5 "	0.50	1 Hektoliter.	100.00
1 Liter.	1.00	2 "	200.00

What numbers are constantly repeated in these columns?

1, 2, 5, and their multiples.

Are you familiar with anything now in use in which these numbers are used in the same way?

The United States money.

Is there any advantage in using the same series of numbers for both measures and money?

It is the best possible arrangement for a rapid calculation of prices.

Does the United States money form part of the metric system?

It does.

Why?

Because of its decimal character.

Will you repeat the table of measure of capacity?

10 milliliters (ml.) make 1 centiliter, cl.
10 centiliters make 1 deciliter, dl.
10 deciliters make 1 liter, l.
10 liters make 1 dekaliter, Dl.
10 dekaliters make 1 hektoliter, Hl.
10 hektoliters make 1 kiloliter or ster, Kl. st.

Will you give three of these measures which have equivalent measures of volume?

1 kiloliter is the same as 1 cubic meter.
1 liter " " .1 cubic decimeter.
1 milliliter " " 1 cubic centimeter.

Can you state briefly the substance of this chapter?

Measure all capacities in liters, using decimal fractions only, and saying deci for tenth, centi for hundredth, milli for thousandth, deka for ten, hekto for hundred, and kilo for thousand.

EXAMPLES FOR PRACTICE.

1. Write 3 liters, 3 deciliters, 3 centiliters, 3 milliliters.
2. Write 2 kiloliters, 2 hektoliters, 2 dekaliters, 2 liters.
3. Find the sum of 250 l. 20 Hl. 30 l. 3 cl.
4. Find the sum of 9 Hl. 10 Kl. 9 cl. 9 l.
5. From 2 Hl. take 10 l.
6. From 4 times 25 Hl. take 4 times 25 l.
7. Divide a hektoliter of corn among 100 persons. How much will each have?
8. If a milkman sells 50 liters of milk to one customer, 25 liters to another, 10 liters to a third, a double liter to a fourth, and a half-liter to a fifth, how much does he sell to all?
9. At 6 cents a liter, what will be the monthly milk bill of a family which uses 6 liters of milk a day — four weeks in the month, Sundays not reckoned?
10. At 10 cents a liter what costs a dekaliter of walnuts?

CHAPTER 6.

MEASURING WEIGHT.

How do we buy and sell such articles as tea, coffee, sugar, etc.?

By weight.

How do we find the weight?

By putting the substance on scales and finding what weights of iron or other metal will balance it.

What names are given to the weights used?

Pounds, ounces, drachms, etc.

What are the weights of the metric system?

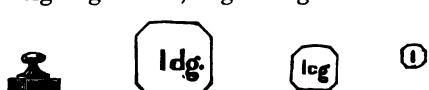
Grams, kilos, etc.

What is the name of this small brass weight? [1]

A gram.

What is weighed with so small a weight?

Gold and silver, medicines, and all small or very costly articles. It is used in the post-offices for weighing letters, 15g. being one rate.



What do the figures represent?

The size and shape of the brass gram and the other still smaller weights.

What are the names of the smaller weights?

Decigram, centigram, milligram.

[1] The learner should see and handle the weights.

What are the larger and heavier weights?

The dekagram, the hektogram, the kilogram.

Of what metal are they made?

Those here represented are of brass, but for common use they are of iron, and of a different shape.

In weighing sugar, tea, and such substances as we now weigh by the pound, what weight is used?

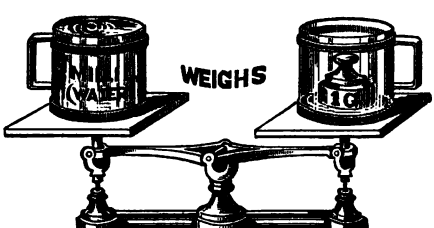
The kilogram, which is commonly called the kilo. It is about two pounds. The half kilo is one-tenth heavier than a pound.

How was the weight of the kilo fixed upon as a standard?

A liter of distilled water at its greatest density[1] — 4° centigrade above freezing — was weighed with the utmost care, and the weight that balanced the liter of water was named a kilogram, or 1000 grams.

What is the gram weight?

Just what will balance a milliliter, or, as it is called, a cubic centimeter of distilled water.



What does this figure represent?

A milliliter (or cu. cm.) of water just balanced by the brass weight called a gram.

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[1] Explain that 4° metric is equal to 39.83° Fahrenheit, and also the interesting law of contraction and expansion by which ice floats and the lives of fish are preserved.

If distilled water were to be bought, which would be the most costly, a cubic decimeter, a liter, or a kilogram of it?

They would all be of equal value.

Which would be the most costly, a gram, a cubic centimeter, or a milliliter?

All would be of the same value.

Are any weights used besides the denominations already mentioned?

Yes; the halves and doubles of all the denominations are used.

This was also the case with the capacity measure. Why are halves and doubles chosen?

Because they are the best adapted to decimal operations.

Why?

The intermediates should not include fractions. Every denomination being 10 times the next smaller, no intermediate numbers but 2 and 5 can be used without introducing fractions. Five times any denomination being half the next larger, the series takes the form of halves and doubles.[1]

What is the table of weights?

10 miligrams (mg.) make 1 centigram, cg.
10 centigrams make 1 decigram, 1 dg.
10 decigrams make 1 gram, g.
10 grams make 1 dekagram, Dg.
10 dekagrams make 1 hektogram, Hg.
10 hektograms make 1 kilogram, K.

Will you name the three principal weights and their equivalent measures of volume?

1 gram is the weight of 1 cubic centimeter of water.

[1] See page 40 for questions which should be asked here as in capacity measure.

1 kilo is the weight of 1 cubic decimeter of water.
1 ton is the weight of 1 cubic meter of water, and is 1000 kilograms.

EXAMPLES FOR PRACTICE.

1. Write twenty-five kilograms and twenty-five grams.
2. Add twenty grams, seven decigrams, twenty kilograms, ten tons, three milligrams.
3. If butter is 45 cents a kilo, what will 50 K. cost?
4. When sugar is 18 cents a kilo, what will be the cost of 1 ton?
5. Bought 50 K. sugar at 20 cents, and sold it at 18 cents a kilo. What did I lose?
6. A market wagon carries 500 K. corn meal, 25 K. butter, 10 K. tea, 20 K. sugar. What weight in the wagon?
7. What will cost 4 K. sugar at 16 cents the kilo, 6 K. rice at 10 cents the kilo, 5 K. beef at 40 cents the kilo, 10 K. coffee at 60 cents the kilo?
8. From 500 kilos of sugar are taken 308 packages, of a kilo each. How much is left?
9. Among how many persons can 100 kilos of flour be distributed, giving each 10 K.?
10. A druggist wishes to put up a kilo of quinine in boxes of 1 gram each. How many boxes will he need?

Can you state briefly the entire substance of this book?

Measure all lengths in meters, all capacities in liters, all weights in grams, using decimal fractions only, and saying deci for tenth, centi for hundredth, milli for thousandth, deka for ten, hekto for hundred, kilo for thousand, and myria for ten thousand; measuring all surfaces and volumes by the squares and cubes of the measures of length, calling a square dekameter of land an *ar*, and the cubic meter of firewood a *ster*.

ANSWERS.

[Of two or more forms of an answer, the first is preferable.]

Page 17.

1. $5^{m.}$
2. $8^{m.}$
3. $10^{m.}$
4. $10^{m.}$ or $1^{Dm.}$
5. $15^{m.}$
6. $15^{m.}$ or $1^{Dm.}5$
7. $305^{m.}$
8. $305^{m.}$ or $3^{Hm.}5^{m.}$
9. $6456^{m.}$
10. $6456^{m.}$ or $6^{Km.}4^{Hm.}5^{Dm.}6^{m.}$

1. $5^{m.}6$ or $5^{m.}6^{dm.}$
2. $55^{m.}67$.
3. $455^{m.}678$.
4. $30^{cm.}$ or $3^{dm.}$
5. $8^{cm.}$
6. $9^{mm.}$
7. $300^{cm.}$
8. $9758^{mm.}$
9. $5555^{m.}$ or $5^{Km.}555$.
10. $5^{m.}555$.

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1. $74^{Km.}425545$.
2. $243^{Km.}055$.
3. $90^{Km.}411388$.
4. $44^{m.}444$.
5. $415^{m.}$
6. $415^{m.}$
7. $36^{m.}158$.
8. $7707^{Km.}077$.
9. $11111^{m.}11$.
10. $3208^{Km.}065$.

1. Lengths $75^{cm.}$, widths $52\frac{1}{2}^{cm.}$
2. $4^{m.}30$.
3. $2^{m.}15$.
4. $10^{m.}50$.

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5. $655^{cm.}$ or $6^{m.}55$.
6. $183^{Km.}$
7. $5^{Km.}$
8. $386^{Km.}$
9. $5506^{Km.}$
10. $5892^{Km.}$

1. $2070^{Km.}$
2. $8140^{Km.}$
3. $75{,}200{,}000^{Km.}$
4. $6^{mm.}$

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5. $10^{cm.}$
6. No difference.
7. $999^{mm.}$
8. $45^{cm.}$
9. $9^{m.}99.$
10. $99^{Km.}9999.$

1. $\$40^{.00.}$
2. $\$100^{.00.}$
3. $\$206^{.00.}$
4. $4^{m.}$
5. $1440^{Km.}$
6. 30.
7. 20.
8. 1000.
9. 100.
10. 1000000.

Page 30.

1. $85^{sq.m.}850085.$
2. $3^{sq.m.}030303.$
3. $10^{sq.m.}101010.$
4. $9^{sq.m.}000909.$
5. $4^{sq.m.}0004.$
6. $55^{ca.}$ or $55^{sq.m.}$
7. $55^{a.}$
8. $55^{Ha.}$
9. $50^{Ha.}5050.$
10. $1^{Ha.}0101.$

Page 31.

1. $\$3200^{.00.}$; $600^{m.}$ $600^{m.}$ $400^{m.}$; $1066\frac{2}{3}^{m.}$

2. $91^{a.}$ or $91^{sq.Dm.}$
3. $4170^{sq.m.}$
4. $38^{Ha.}542.$
5. $5^{Ha.}0505.$
6. $24^{Ha.}75.$
7. $59^{a.}40.$
8. $24^{Ha.}816.$
9. $25^{a.}$
10. 20000.

Page 36.

1. $20020^{cu.m.}$ or $20^{cu.Dm}$ 02.
2. $5^{cu.m.}.005005005$.
3. $102^{cu.m.}.283$.
4. $249^{cu.m.}.99975$.
5. $259^{cu.m.}.99974$.
6. $16^{cu.m.}$

Page 37.

7. $16^{cu.m.}$
8. $8^{cu.m.}$
9. 25 sters.
10. 25000.

1. $27^{s.}.39$.
2. $24^{s.}.375$.
3. 1500 piles.
4. $3000.
5. 15000 times.
6. 500 hours.
7. 1 ster.
8. $24664^{cu.m.}$
9. $12^{c.c.}$ $988^{c.c.}$ left.
10. 100.

Page 41.

1. $3^{l.}333$.
2. $22^{Hl.}.22$.
3. $2280^{l.}.03$.
4. $109^{Hl.}.0909$.
5. $1^{Hl.}.9$.
6. 99^{HL}
7. $1^{l.}$
8. $87\frac{1}{2}^{l.}$ or $87^{l.}.5$.
9. $\$8.^{64}$
10. $\$1.^{00}$

Page 45.

1. $25^{K.}.025$.
2. $10020^{K.}.020703$.
3. $\$22.^{50}$
4. $\$180.^{00}$
5. $\$1.^{00}$
6. $555^{K.}$
7. $\$9.^{24}$
8. $192^{K.}$
9. 10.
10. 1000 boxes.